Experiment 62: Explosive Copper Thermite!

Copper thermite is notorious for being violent and even explosive, so naturally, it was next on my list of thermites to try. I began by weighing my 49.25g of copper (II) oxide made in *Experiment 54: Making Copper Oxide for Thermite*. I divided this mass by 4.42 (derived from stoichiometry) to get the required mass of homemade aluminum powder, which was 11.12g. I mixed them thoroughly to ensure a fast reaction and then set aside 45g for later. With the 15g I now had, I used a homemade electric match (wire filament + kitchen match) to ignite it with the press of a button. I wanted to capture the reaction on slow-motion, but my Nikon 1 J1 only records slow-motion for five seconds, so I had to have the thermite ignite at a precise time. The electric match was better for this than a magnesium ribbon.

I was quite impressed by the speed and violence of the reaction. It was all over in less than a fifth of a second, and the cloud of smoke it created made a smoke ring at least a yard in diameter. It was quite amazing to see.

https://www.youtube.com/watch?v=LEvCJHDvyIQ

I wanted to make molten copper with the rest of the thermite. Since my unmodified copper thermite blew everything out of the paper cup I put it in, I diluted my copper thermite with 17g of borax powder in a 2.5:1 ratio. In a previous small-scale test, the borax had slowed the reaction and acted as a flux to liquefy the alumina slag created by the thermite. This helped separate the molten copper from the slag. Since this thermite reacted more slowly, I ignited my large batch of it using a magnesium ribbon. It started off well, but then the thermite fizzled and continued to sputter for a few minutes. Since my small-scale test of the composition worked well, I think that the large batch didn't perform because I had lightly pressed the thermite down before igniting it. Maybe this didn't let the fire travel quickly enough.

Although the slow thermite was a bit of a disappointment, it did make solid copper pebbles, which is more or less what I was aiming for. I used a hammer to pulverize the slag and then washed the mix with water to float away the less-dense slag. This actually separated the copper out quite well, and in the end, I recovered 3.55g of copper granules. This is a 9% yield, which isn't terrible, considering the thermite seemed to sputter instead of flaring up nicely. In any case, my expectations were "blown away" by the fast copper thermite smoke ring, so I consider this experiment a success.